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ABSTRACT

Science, society, nature, and culture are interacting forces on the lives of all people. They become increasingly complex with time. In this address, a perspective of science, technology, and society is offered and suggestions and recommendations are made for how teachers can and should integrate this topic effectively into instructional programs. The paper advocates earth-based education and shares her concern for the future of this planet. Science, technology, and society programs are about decision-making and critical-thinking. It is suggested that these programs must be taught with an ecological foundation, in the larger context and framework of environmental understanding. Specific suggestions regarding this theme are included. Specific environmental education materials are identified for this type of program. (CW)

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A NECESSARY SYNTHESIS:

CREATING AN ECOLOGICAL, WHOLE LEARNER APPROACH

TO TEACHING AND LEARNING ABOUT SCIENCE, TECHNOLOGY, AND SOCIETY

By Cheryl Charles, Ph.D.

Director, Project WILD

Address to Ohio's Third Annual

Statewide Science Staff Development Conference

Wednesday, October 15, 1986

Center of Science and Industry, Columbus, Ohio

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I am particularly delighted to have this opportunity to address this conference with the theme, "Science, Technology, Society--A New Perspective in Science Education." In 1978 I had the privilege of co-editing with my husband, Bob Samples, the Yearbook of the National Council for the Social Studies. The title of that yearbook was, Science and Society: Knowing, Teaching, and Learning. Articles were contributed by Jonas Salk, Carl Rogers, Fritjof Capra, Rollo May, Margaret Mead, and others. Last year I had the opportunity to contribute a chapter to the 1985 National Science Teachers Association Yearbook entitled Science, Technology, Society. Let me read you a quote from each of these publications. Jonas Salk said, in the first book:

"Wisdom, understood as a new kind of strength, is a paramount necessity . . . Now, even more than ever before, it is required as a basis for fitness, to maintain life itself on the face of this planet, and as an alternative to paths toward alienation or despair."

In the second book, I opened my chapter with a quote from Edward Abbey. Abbey said, "Without necessarily rejecting either science or technology, it seems to me that we can keep them as servants, not masters, only by doing our best to preserve the variety and openness of life on earth."

Some of you may know that I actually started my work in the field of education as a high school social studies teacher--teaching government and history, impassioned with politics and the study of social processes in this society. My birthday falls on November 4--often a national election day, as it is this year--so paying attention to the interaction of science and society seems to have been unavoidably fundamental to my life since birth. At the same time, I grew up in a family with a strong, ecological conscience. My grandfather was a conservationist all of his life--working for the U.S. Forest Service more than 40 years.

My greatgrandfather was instrumental in protecting the unique White Sands of New Mexico, successful in helping to make that area one of this nation's National Monuments. Science and society, nature and culture. Those interacting forces have certainly helped to define my life. I would like to suggest that they are an inevitable interacting influence on each of our lives, with increasing complexity as each day passes. So, again, I am delighted to share some thinking with you today about the topic and its implications for those of us concerned about education.

I will offer a perspective about "science, technology, and society," and I will offer suggestions and recommendations for what I think we as teachers can and should be doing to integrate this topic more effectively into our instructional programs.

But first, why should we? For help with the why question . . . the why should we be teaching any of this any way question, let me begin with the music and words of a friend who cares a lot about these questions, John Denver. This is a song from a brand new album, One World. The song is called, "It's A Possibility."

It is a possibility--no more sorrow. No more planetary sorrow. No more ecological sorrow. Surely there will be community sorrow, personal sorrow. But there will also be joy. It is a possibility, and it is a challenge. Why? It is as basic as survival itself.

I speak to you as an advocate for what I call earth-based education. This means I am concerned about the whole of the planet--its physical properties, its delicate webs of profoundly diverse life, and the incredibly varied human families whose inventions include science, technology, and society. I am concerned about the sustainability of life on this planet, now

and in the future. The earth came first, with natural systems. Humans came along and communicated with one another. We created social structures; we created societies. We invented technologies as means of helping us get along within our natural and cultural worlds. We invented science in part as a way to help us explain and understand what we were doing. Society, technology, science--all of these exist within the larger context of the environment of the natural world itself.

"Science, Technology, Society" is a buzz-phrase today. Like a buzz word, but it's a buzz phrase. People are talking about it, it seems to be important, because so many people are talking about it, but what is it? At its most fundamental, it is simply the interaction between human beings and the natural world, between people and their environment, between culture and nature. It includes some of the special characteristics of human interaction with our environment in this Information Age, the post-Industrial era. The word technology connotes some of the

"high-tech" attributes of this new era in which we live. The term, "Science, Technology, Society" is used to represent an emerging area of priority in education. The term is not particularly new, but it is current--another age-old, "brand new" idea. For many years, philosophers, scientists, cultural visionaries, and world leaders have recognized that citizens simply must have the knowledge, skills, and experience to make informed and responsible decisions affecting and affected by the interaction of the natural world and human values. How can we create and use nuclear technology without an understanding of its potential impacts on the living world and generations to come? How can we create, use and dump toxic wastes in our lands and waters without some consideration of the consequences? What are the tradeoffs when we let fish die in wilderness lakes as a result of our burning of fuels in the atmosphere? What are the tradeoffs when we let our children, our parents, and our friends die from contact with poisons we--collectively--have put in the environment . . . in the air we breathe, the waters we drink, the

foods we eat? What are the tradeoffs when we individual citizens buy packaged foods, turn on a light switch, drive miles daily to and from work, and cast our votes for representatives, senators, and presidents?

"Science, Technology, Society" is about decisionmaking. It is about critical thinking. It is about acquiring the knowledge, skills, attitudes, and commitment to make informed and responsible decisions affecting the quality of life, now and in the future. And it is about the fact that everything cannot be kept separate in tidy boxes and categories. We cannot study civics and government without also paying attention to the scientific knowledge that underlies many of the decisions we will be asked to make when we cast our votes for community and national leaders. We cannot expect to develop new scientific technologies designed to make life easier, in our judgement, for people without consideration for the preferred community values of those we think we will serve. I am vitally concerned about

the fact that every day, every single one of us--and the children with whom we work--make decisions and take actions that affect the future of life on this planet. There are no easy answers to all the dilemmas these actions raise. Thoughtful people may genuinely disagree as to what choices should be made. The proper function of education, I believe, is to help prepare our youth to make these difficult choices and decisions. Otherwise, our choices are made by default. We need to be prepared to make decisions on the basis of the best available knowledge and with benefit of skills of analysis and decision-making in an ultimately ambiguous world. We are never going to have every answer we need. There are fewer and fewer "answers" in an increasingly complex world. But there are some basics we need to study, and which we do have available to us. The most fundamental to life itself is simply outside--outside the classroom and school building doors, out to the first classroom . . . the natural world.

As we as a society have grown less responsible for securing our own food and other needs, we have grown separate from understanding how the world works. As a result, to an increasing and alarming degree, when we do go outside we inadvertently do damage to wildlife, plants, and whole environments--now, and for future generations. We plant lawns in areas where water supplies are limited. We introduce exotic wildlife and vegetation that jeopardize native plants and animals. We drain wetlands and spray roadside vegetation, destroying natural habitats for wildlife in our communities. We eliminate whole areas of habitat regularly, destroying those areas as places in which wildlife--plants and animals--can live. We scar the earth with our recreational vehicles, damaging vegetation, creating erosion which affects water quality, and leaving marks upon the earth that will be there when our grandchildren have grandchildren. We dump pesticides in our water supplies. We simply do not know how to take care of the garbage we produce and the toxins we generate. We poison ourselves, our children, the plants,

animals, skies, waters, and the living earth that is our home. In the face of all this, we need basic ecological education. We need what I call earth-based education. We need more of what is popularly called conservation and environmental education. And we can benefit greatly by leadership among science educators, social studies educators, and other curriculum leaders who are today emphasizing education about "science, technology, and society."

My great concern, and it is a major one, is that education about "science, technology, and society" will be taught without an ecological foundation. I believe it must be taught within the larger context and framework of understanding of the environment--the natural and cultural environment. I worry when people talk about science, technology, and society instruction as if it were only an examination of a narrow interface between technology, people's uses of technology, perhaps conflicting values about the appropriate uses of such technology, and, perhaps, by what

scientific processes this technology came to be invented. That narrow interface is an appropriate and important part of what we need to study; it is not the whole. It is not enough to examine people and our tools without also remembering to look at the planetary home within which this interaction takes place.

Let me share with you two recent anecdotes, and then offer a few recommendations for some of what I think you and I can do to constructively see education about science, technology, and society as an effective part of public schooling today.

Students in a Denver metropolitan area elementary school successfully protected a nine-inch tall shore bird that chose to nest on the school playground. Amid the bustle of school life, the bird laid eggs and hatched her young. Playground activities and sports were suspended in the area where the bird was nesting. The students' teachers helped the students learn about the bird and its needs by using instructional activities from a

widely used conservation and environmental education program. The bird and young eventually departed--leaving the students richer in understanding and respect for their own natural environment. (I first saw this reported on television; for those of you who know Project WILD, I later found out that one of the activities the teachers used was "Too Close for Comfort.")

High school students in Lee County, Florida worked over a three year period to preserve a cypress swamp destined for development within their city limits. As a swamp, the site was valuable for ecological, scientific, wildlife, and recreational uses. Preserving the swamp required voters to pass a referendum to increase their own taxes for its purchase--obviously not an overwhelmingly popular notion in a community abundant with fixed-income, retirement families. The referendum was passed with the highest plurality ever given to a tax issue in the county.

These anecdotes--based on actual recent occurrences--are offered as evidence that people who care about their environment can make a difference. Especially significant, young people can make a difference. These are elementary and secondary students in public schools in this country. The students cited are not particularly unusual, nor are the communities in which they live. What's important about what these students were able to learn and accomplish? They were able to make a difference to protect and maintain the quality of life in their own communities. They were learning to be responsible members of their own ecological community as well as their cultural community of family, friends, and neighbors. Some actions are small, some are large, but each individual action does make a difference. That is a part of what these students learned.

Each of these situations took place where a classroom teacher took the time to take students outside, to see how the world works. The teachers emphasized the importance of people living

as responsible members of healthy natural environments--one of the fundamental lessons to be learned in examining issues of science, technology, and society. This kind of responsibility does not mean that we humans necessarily have all the answers. We don't. It does mean that we humans can learn to be more responsible for the consequences of the actions we do take--paying attention to the effects of our actions on others, including plants, animals, and the rest of the natural environment.

What can we do?

1. <u>DO something every day with our students that reminds them, and us, of our fundamental connections to all other life forms.</u> You're going to say, "How can I do this on top of everything else I am already doing?" It's not "on top." It's as part of. Often--most often--it's just a matter of focus, a change in emphasis. It also has to do with the classroom environment, and

this is relatively easy to do. Make the classroom environment interesting and obviously connected to the natural, living world. Most of you who are elementary teachers are doing this already--including plants, photos and posters of living things, natural artifacts like rocks and sand--and other interesting "stuff." It can be done appropriately at the secondary level as well. The instructional part is a little more difficult, but there are a lot of different things we can do. The materials I have helped develop over the years--including Project WILD and Project Learning Tree--are designed to help you integrate concepts related to the environment--including science, technology, and society topics, into every major subject and skill area, K-12. You can be using instructional activities from these kinds of programs at the same time you are teaching concepts and skills in your textbooks and required courses of study. Even easier than incorporating full-fledged earth-based instructional activities within your curriculum every day--which I really do not expect you to do given everything else you are

doing, although once a week would be excellent--even easier are the subtle things. It might be as simple as checking the growth of a plant, or looking outside a school window for the first sign of other life--a butterfly, a bird, an ant, another student. Such small and quick moments of focus can help to nourish that essential sense of connectedness which we need, reinforcing the idea that this earth is home to more than just people. Establishing that ecological foundation helps to prepare our students for making more informed decisions later that have an impact on the environment.

2. Take the time to do the planning and work necessary to actually integrate science, technology, and society within an ecological context into the mainstream curriculum. I do know this takes time. I also believe it is worth the effort. There are materials and people available to help you.

3. Literally, go outside whenever you can. There is nothing more powerful than first-hand experience with the living world. Margaret Mead said once--and I still find it compelling:

"When we teach young children to become citizens in our world that depends upon science and technology, the problem is to convey to these children something about life, something about what they share with living things, and something about observing nonliving things in the environment. We must introduce children to living things and not just dead dogfish or whatever, or pictures of dead dogfish, or diagrams of pictures of dead dogfish. We can take our children outdoors, out into the living world . . . If children feel themselves part of the living world, learn respect for it and their uniqueness in it, they will have a foundation for growth into responsible citizens who will be able to discriminate and make decisions about science used for constructive purposes and the science used for destructive purposes."

4. Teach ourselves and our students to say, "How will this action I am taking affect me tomorrow? How will it affect other life forms--plants and animals--today and tomorrow?" We must learn to make our decisions with some respect and recognition for the consequences of our actions.

5. Don't be immobilized with despair, frustration, and fear. We really can make a difference, and so can our students. Hunter and Amory Lovins--leaders in alternative energy and economics--said at a conference last June that the conservation practices of individual citizens during the 1970s and early 1980s actually generated more sources of energy than all new development of energy sources combined in gas, coal, oil, and nuclear. That's wonderfully exciting! It's not too exciting that we citizens have not heard much about that news in the public media. Ah yes, another example of the compelling interaction between science and society, how the world works and the effects of cultural values

and systems. And the students I described for you are just two examples of wonderful things happening all over this country, in Canada, and in other parts of the world. And the teachers, teachers similar to you. I have had the privilege now to work at the national level in the field of education about the environment since 1973. During these years, I have worked with teachers from literally every state and several provinces--most often in weekend long workshops where we get to share ideas, hopes, dreams, and concerns. I can assure you that whereas there are wonderful idiosyncrasies that characterize the diverse people and communities of this nation, there is also a heartening, inspiring sense of similarity. We care about teaching, we care about the promise of each individual child and learner of any age, we work under difficult and challenging circumstances--often not sufficiently appreciated or supported. But we're here--and we're out there--and I believe we are all, each of us, doing the best we know how to do.

So I would encourage you, do make the effort now to integrate concepts and skills related to issues of science, technology, and society into your day-to day-teaching. I personally hope you do so in the context of education about the environment because I think that larger framework provides us with more of the essential understandings we need for the long term in order to meet our goals of informed and responsible decision making for a healthy, sustainable future. Do believe you can make a difference. I am sure you can. And I am sure your students can.

Again, why teach any of this? Survival itself is at stake, and certainly the quality of life for all the co-inhabitants of this planet, not just people.

What should we teach? About nature and culture in a dynamic natural balance--with issues of science, technology, and society seen in a larger ecological, whole environment context.

How can we do this? Integrate earth-based education into every aspect of the curriculum with emphasis on two things--1) how the world works; and 2) skills for responsible decision making.

The approaches you take will be diverse. That's appropriate and in fact to be desired. Diversity is certainly a sign of health in natural environments. I hope you will forgive what has had to be a quick look at many important issues and questions. I will be here throughout the day, and am happy, as the format allows and time is available, to answer any specific questions you might have. There are materials and professional development opportunities to help you. I personally would urge you to look at Project Learning Tree; Project WILD; the Class Project; and Energy, Food, and You as examples of instructional materials and workshop opportunities that can be of assistance. Each of these programs and materials happens to come from the perspective of education about the environment and each is abundant with background information and classroom teaching activities that can

help you integrate science, technology, and society into your curriculum with a grounding in an ecological context. There are others, and your program here for the next few days reflects that healthy diversity. You also have an abundance of talent and experience right here in this state who can help you. There are so many. I will run the risk of mentioning only a few with the intent to illustrate, not omit--but John Hug with the Ohio Department of Education; your state environmental education association; Nancy Ann Eberhart and now Kay Wagner in the Department of Education; John Disinger and the others of the incredible crew of people at Ohio State University; and the amazing Lilabelle Holt. These are only a few, but your leadership in this state really does influence the nation. We thank you for that.

Let me close in two ways. First, I would like to read a statement I wrote in 1978 and second I would like to leave you with words and music again from John Denver.

This statement was written as a part of that 1978 National Council for the Social Studies Yearbook entitled Science and Society: Knowing, Teaching, and Learning that I mentioned when I began speaking to you today. I believe the words that Bob Samples and I wrote in the Introduction to that book as much today, and more:

"The basic skills can be acquired; substantive information can be gathered; processes of scientific inquiry, creative thinking, and decision making can be developed and honored; moral and ethical issues can be recognized and thoughtfully studied; and all of this can be done with teachers and students sharing an overriding awareness of the inevitable, infinite interactions between human beings and nature. Science and society cannot remain separate; culture and nature must be seen as an integrated whole; and learners of all ages must feel their place again with the oneness of nature." It's about time.